The second operation unit 55 divides the value **Va** calculated by the butterfly operation at the final stage of the predetermined number of stages **n** by the final scale factor **Sfn**, and then outputs the result.

The division and multiplication selection unit 51 calculates a difference value **L** between the predetermined number of stages **n** and the scale count **Sc**, and determines the selection signal **D** whether it is for the division operation or the multiplication operation, and then outputs the difference value **L** and the selection signal **D**.

The coefficient calculation unit 53 calculates the coefficient **R** required for compensating the input bit signal from the difference value **L**.

The division and multiplication calculation unit 57 selectively performs the division operation and the multiplication operation on the value **Si** from the second operation unit 55 according to the selection signal **D**, and then yields a result value **So**.

The bit compensation unit 58 receives the coefficient **R** from the coefficient calculation unit 53, the selection signal **D** and the value **So**, and compensates for the value **So** according to the coefficient **R** and the selection signal **D**, resulting in the compensated value **t**.

The adder unit 59 adds the compensated value **t** (input from the bit compensation unit 58), and then outputs the result.

The second operation unit 55 divides the bit value **Va** of the butterfly operated signal at the final stage of the predetermined number of stages **n** by

the scale factor **Sfn** calculated at the final stage, and then outputs the result value **Si=Va/Sfn**.

The division and multiplication selection unit 51 compares the predetermined number of stages **n** with the output value **Sc** from the scale count unit 41 to yield the difference value **L**, by the following arithmetic expression:

$$L = |Sc - n| \qquad (2)$$

The division and multiplication selection unit 51 also yields and outputs a selection signal **D** for determining between the division operation and the multiplication operation. If the predetermined number of stages **n** is greater than **Sc**, then the selection signal is set for the division operation, while if the scale count **Sc** is greater than **n**, then the selection signal is set for the multiplication operation.

The coefficient calculation unit 53 calculates and outputs a quotient **Q** and remainder **R** by dividing the difference value **L** from the division and multiplication selection unit 51 by **2** as the following arithmetic expression:

$$L/2 = 2Q + R \qquad (3)$$

The division and multiplication calculation unit 57 calculates and outputs the multiplication result **So** obtained by multiplying the value input from the second operation unit by 2^Q if the selection signal is for the multiplication operation, while the division and multiplication calculation unit 57 calculates and outputs the division result **So** obtained by dividing the value

input from the second operation unit by 2^Q if the selection signal is for the division operation by the following arithmetic expressions:

$$So = Si \times 1/2^Q \text{ (if } D = D2) \qquad\qquad (4)$$

$$So = Si \times 2^Q \text{ (if } D = D2) \qquad\qquad (4)$$

The bit compensation unit 58 outputs the data **So** intact from the division and the multiplication unit 57 to the adder unit 59 if the remainder **R** of the expression 3 is not "1"

The bit compensation unit 58 calculates and outputs the multiplication results **t1=t11, t12, t13, t14** to the adder unit 59 after multiplying the data **So** from the division and the multiplication calculation unit 57 by **1/2, 1/8, 1/16, 1/64**, respectively, if the remainder **R** of the expression 3 is "1" and if the selection signal input is for the division operation **D1**, which can be expressed by the following arithmetic expressions:

$$t11 = So \times 1/2$$

$$t12 = So \times 1/8$$

$$t13 = So \times 1/16$$

$$t14 = So \times 1/64 \qquad\qquad (5)$$

Alternately, the bit compensation unit 58 calculates and outputs the multiplication results **t2=t21, t22, t23, t24** by multiplying the data **So** from the division and the multiplication calculation unit 57 by **1, 1/4, 1/8, 1/32**, respectively, if the remainder **R** of the expression 3 is "1" and if the selection signal input is for the multiplication operation **D2**, which can be expressed by the following arithmetic expressions:

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